

**What is claimed is:**

1. A coupling device for optically coupling an optical fiber to a planar waveguide comprising:

5 an optical waveguiding structure comprising a segmented guiding portion and a tapered guiding portion, each disposed in a lower refractive index cladding region between the fiber and the planar waveguide;

10 the segmented guiding portion comprising a series of spaced apart segments of lower refractive index material, the segments having longitudinal cross sections substantially equal to the cross section of the fiber core and successive segments having increasing axial thicknesses to present to light from the fiber an effective refractive index increasingly approximating that of the planar waveguide as the light approaches the waveguide; and

15 the tapered guiding portion having a longitudinal cross section adjacent the segmented guiding portion substantially equal to the adjacent segment longitudinal cross sectional area and, between the segmented guiding portion and then planar waveguide core, a tapered region tapering the cross sectional area to approximate that of the waveguide core at an axial position adjacent the waveguide core.

2. The coupling device of claim 1 wherein the tapered guiding section has a continuously tapered section.

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3. The coupling device of claim 1 wherein the tapered guiding section has a step tapered section.

25 4. The coupling device of claim 1 wherein the fiber core has a larger cross sectional area than the planar waveguide core.

5. The coupling device of claim 4 wherein the fiber core has a lower refractive index than the planar waveguide core.

5           6. The coupling device of claim 1 wherein the planar waveguide has a high delta core of 4% or greater.

7. The coupling device of claim 1 wherein the planar waveguide has a high delta core of 6% or greater.

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8. The coupling device of claim 1 wherein the waveguiding structure is configured in the form of an optical fiber.

15           9. The coupling device of claim 1 wherein the waveguiding structure is disposed in an integrated optical device including the planar waveguide.

10. An optical fiber coupled to a planar waveguide by the coupling device of claim 1.

11. A coupling device for optically coupling an optical fiber to a planar waveguide comprising:

an optical waveguiding structure comprising a segmented guiding portion disposed on the planer waveguide, the segmented guiding portion and the planer waveguide having  
5 different indices of refraction;

the segmented guiding portion comprising a series of spaced apart segments of lower refractive index material, the segments having longitudinal cross sections substantially equal to the cross section of the fiber core and successive segments having increasing axial thicknesses to present to light from the fiber an effective refractive index increasingly  
10 approximating that of the planar waveguide as the light propagates to the waveguide; and

the segmented portion having a longitudinal cross section adjacent the waveguide substantially equal to the adjacent waveguide longitudinal cross sectional area and, the segmented guiding portion disposed on the planar waveguide core, to propagate light between the segmented portion and the waveguide core.

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12. A coupling device for optically coupling an optical fiber to a planar waveguide comprising:

an optical waveguiding structure comprising a segmented guiding portion, at least one of the segments comprising at least two materials of differing indices of refraction;

20 the segmented guiding portion comprising a series of spaced apart segments, the segments having longitudinal cross sections substantially equal to the cross section of the fiber core and successive segments having increasing axial thicknesses to present to light from the fiber an effective refractive index increasingly approximating that of the planar waveguide as the light propagates between the fiber and the waveguide.

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